Exploring Microbiology

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Exploring Microbiology

Key Words

There are a few key words you'll need to know.

The word microbe is shorthand for microorganism **(mai-krow-aw-guh-ni-zm)**.

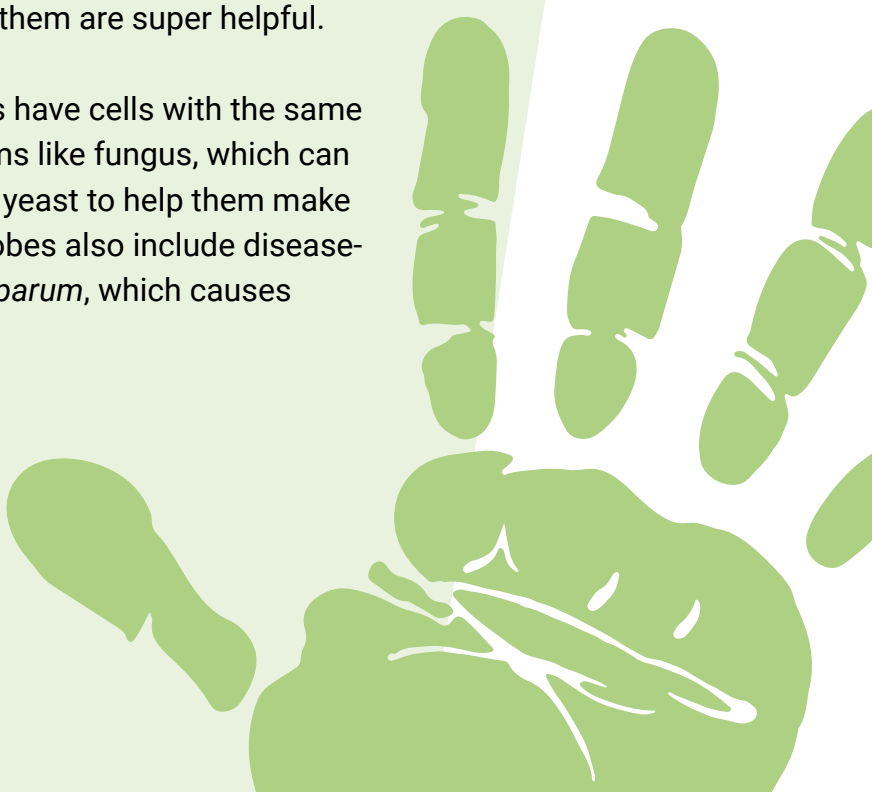
Micro means small. What then, is an organism? You are one! So are dogs, cats, and all animals. Plants are organisms, and so are fungi. In fact, an individual of anything that's alive is an organism.

Microorganisms might be tiny, but they come in a variety of shapes and (small) sizes. They live in a dazzling array of different places on the Earth, including on your skin and in your intestines!

Archaea **(are-key-ah)** are a very ancient form of life. They can live in extreme environments, like the bottom of the sea, or in geothermal vents but they are also found in your bellybutton!

Bacteria **(back-tea-ree-ah)** are the best known of the microbes. They are very distantly related to humans, so their cells are very different to ours. Bacteria are found in lots of places...in the soil, in our food, or even inside us! Some are harmful, but lots of them are super helpful.

Eukaryotic **(you-carry-oat-ick)** microbes have cells with the same structure as ours. They include organisms like fungus, which can be helpful. Humans use a fungus called yeast to help them make different types of food. Eukaryotic microbes also include disease-causing parasites like *Plasmodium falciparum*, which causes malaria.



Welcome to the world of microbes

You will explore the amazing world of life at the far end of the microscope. While many microbes are too small to see without help, they have a huge impact in the world.

Did you know that you have one microbe cell on or in your body for every human cell? They live on your skin and in your mouth and in your intestines!

Image credit: Erin Hardee

You can see the microbes that were living on a hand. Someone placed their hand on the agar plate (food for microbes) and transferred what was on the skin. We can see the microbes after they have grown in an incubator.

Microbes shapes and sizes

Bacteria and parasites are single-cell organisms that come in a variety of shapes and sizes. They are very adaptable and can live in almost all environments, partially due to the protective features that help them to survive and thrive.

Many bacteria have a protective wall that lets them survive changes to the environment. Some bacteria have flagella (fla-jell-a), which act as propellers to let the bacteria swim to find food and some are covered in dozens of tiny hairs called pili to help them stick to surfaces.

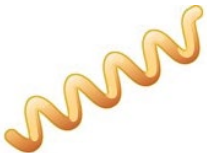
round (coccus)

rod (bacillus)

comma (vibrio)

spiral (spirillum)

corkscrew (spirochaetes)



Some parasites also can move and propel forward. For example, **amoeba** (ah-me-bah), a eukaryotic microbe, can change shape by extending feet-like projections used for feeding.

Leishmania donovani is a parasite which causes the deadly disease Leishmaniasis. It looks like it has a tail – it's called a flagellum (fla-jell-um). It uses it to move – but unlike a tail, the flagellum goes at the front and pulls the parasite along.

Activity 1:
Design your own microbe

Have a go at drawing your own microbe. Be sure to give it a name.

Questions to think about:
- What shape is it?
- Does it have any adaptations to help it survive in the environment?
- Is it a harmful or beneficial microbe?
- If it's a helpful microbe, what is it used for?

Image Credit: Dr. Elliot Erskine

You could also have a go at modelling your own microbe using different materials! Here is an example of a creation by one of our young microbiologists for inspiration!

Activity 2:

Word finder

microorganism

How many different words can you make using the letters in “microorganism”?

We’ll start you off with the word “magic”! Now it’s your turn.

Answers are on page 16

Oral Health Care

Did you know that one of the places that lots of microbes live is in our mouth?

Toothbrushing with a fluoride toothpaste is one of the most effective ways to prevent decay and keep the teeth clean and healthy.

Activity 3:

Toothbrushing

When you wake up in the morning run your tongue around your mouth on your teeth. How do they feel? Shiny or furry? The furry feeling is caused by bacteria growing on your teeth. These bacteria produce acid that can break down the outer enamel wall of protection on your teeth and this is decay. For your teeth to remain healthy and pain free you must clean them. The next time you grab your toothbrush and toothpaste follow our instructions.

Image credit: Toothy Tigers - Robbie Macoy, Clement Seeballuck and Ayeza Tari

Toothbrushing Instructions:

1. Brush twice a day preferably in the morning and last thing at night
2. Don't have anything to eat or drink at night after brushing apart from water
3. Use a fluoride toothpaste
4. Brush for at least 2 minutes
5. Do not brush for at least 30 minutes after eating or drinking something acidic e.g. fruit juice
6. Spit don't rinse once you have cleaned all your teeth

How to brush:

- Make sure all surfaces of the teeth have been brushed.
- Brush all surfaces of a section of the mouth before moving onto the next section in the mouth.
- Use a circular, short scrubbing motion when brushing

How do your teeth feel now? Shiny? Good work!
Keep it up morning and night.

Lichens

Lichens are made of two types of eukaryotic microbes working together:

- Algae
- Fungi

Lichens can survive in lots of different places and often have fascinating colours and patterns.

Image Credit: Prof. Nicola Stanley-Wall, University of Dundee

Activity 4:

Lichen Hunt

Next time you go out for a walk or cycle ride, look around you and see how many different types of lichen you can find.

You can look at trees, walls, signs, pavements, roof tiles, all over!

Can you find any lichen samples?
If you do, note down where you found it and what colour it was.

Microbes in nature: Believe it or not

Leaf-cutter ants: microbes – friend or foe?

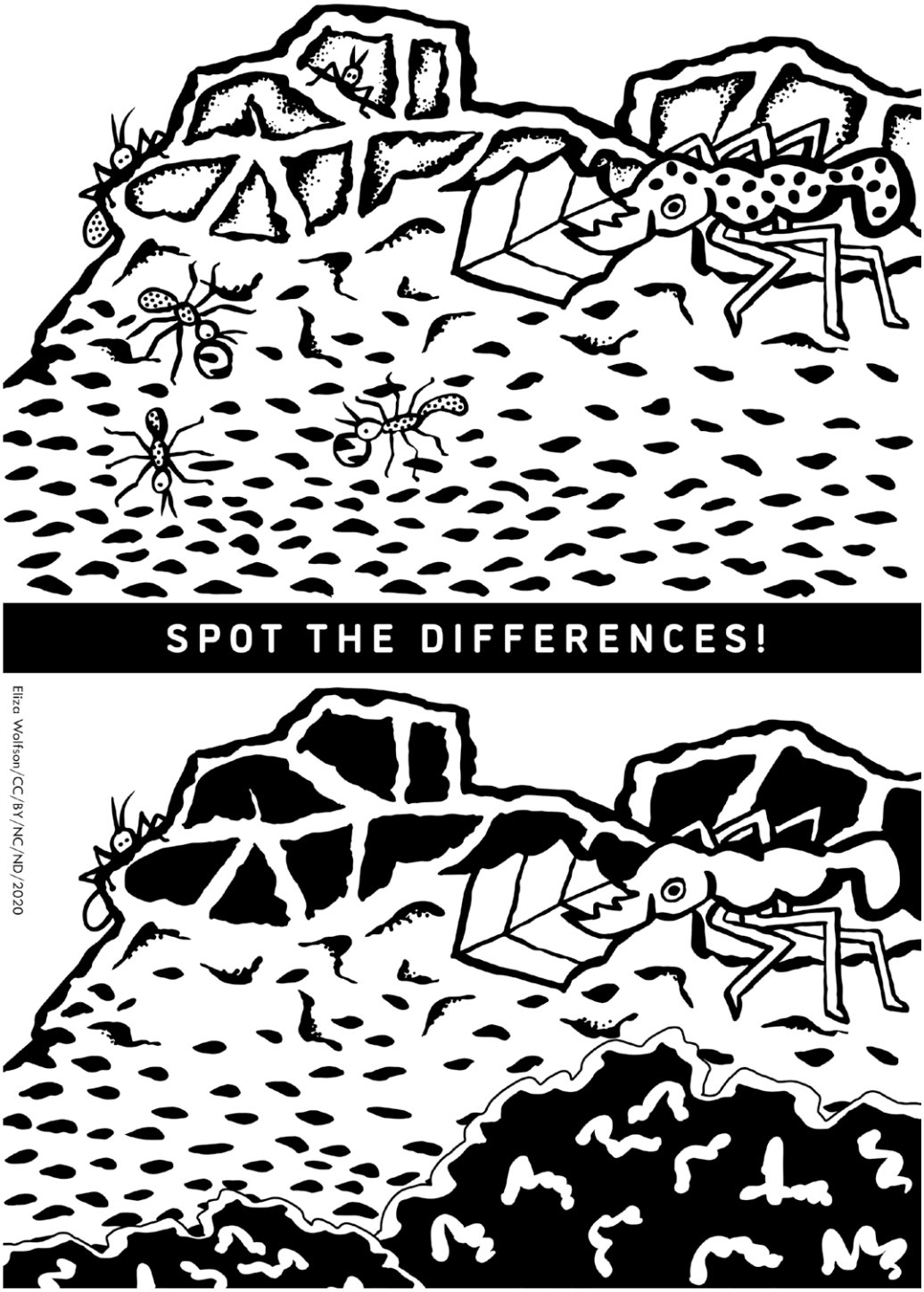
Did you know that leaf-cutter ants are expert farmers? These special ants go on long journeys to find fresh pieces of leaves that they use to grow their food, a white fungus.

Along the way, leaf-cutter ants can encounter a harmful fungus that can destroy their fungus food! Thankfully, the ants have helpful bacteria that live on their bodies and can kill the harmful fungus.

Image Credit: Prof. Matt Hutchings, University of East Anglia

Activity 5:
Spot the difference

Can you see what happens when the ants don't have bacteria living with them? Colour in the picture to highlight the changes.



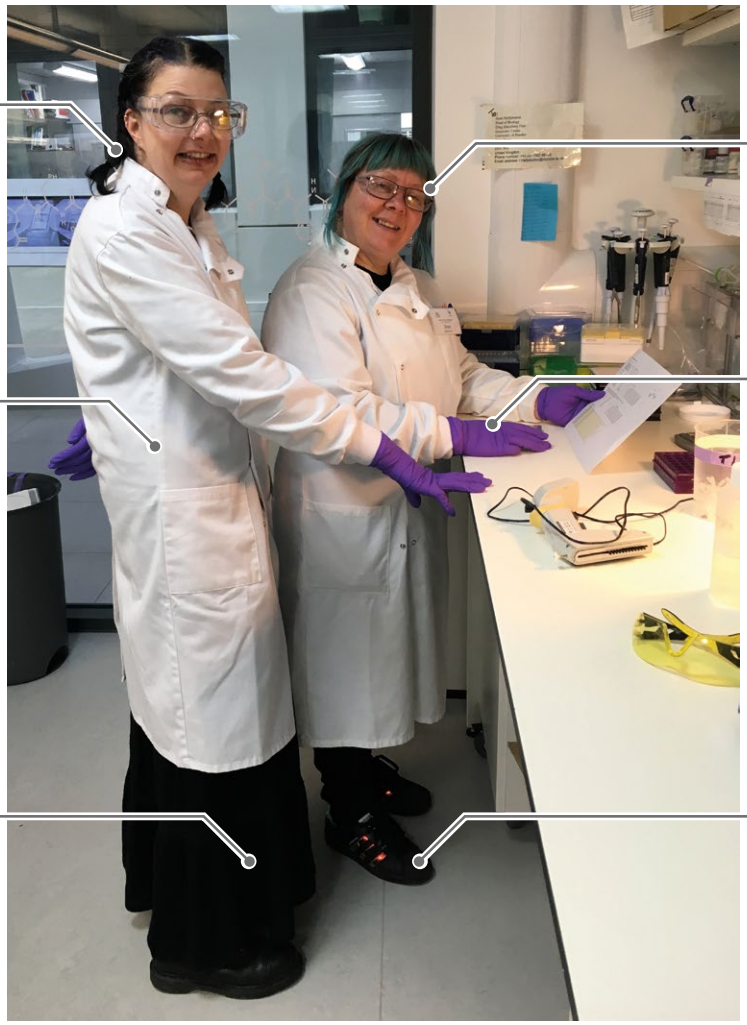
Working as a Microbiologist

Working as a scientist is really exciting. We get to run lots of fascinating experiments working with all sorts of microbes. It's incredibly important that we do that safely – it's our number one priority.

Activity 6:

Health and Safety

Lesley-Anne (left) and Irene (right) are two of our scientists. They are dressed very safely. Can you name each of the items they are wearing? What else have they done to keep themselves safe?

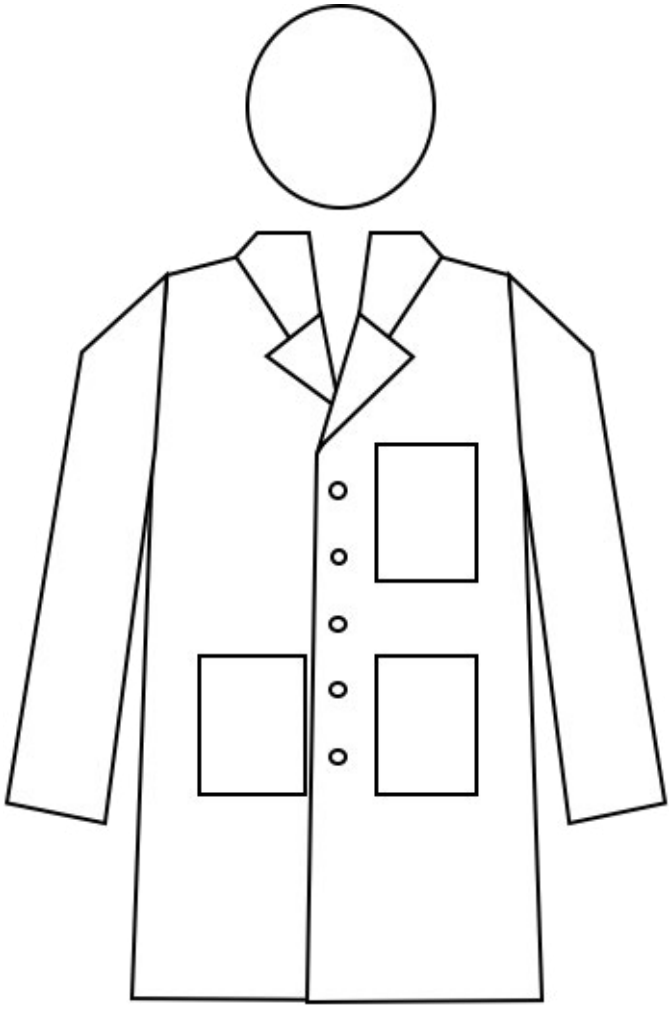


Answers are on page 16

Activity 7:

Design a Scientist

We've set up an outline of a scientist. Draw in what they look like when they're working in the labs. Don't forget to give them everything they need to work safely in the lab! You can give them a name too. What kind of experiments do you think they do?



Microbes in nature: Believe it or not

Sea creatures and their protector microbes

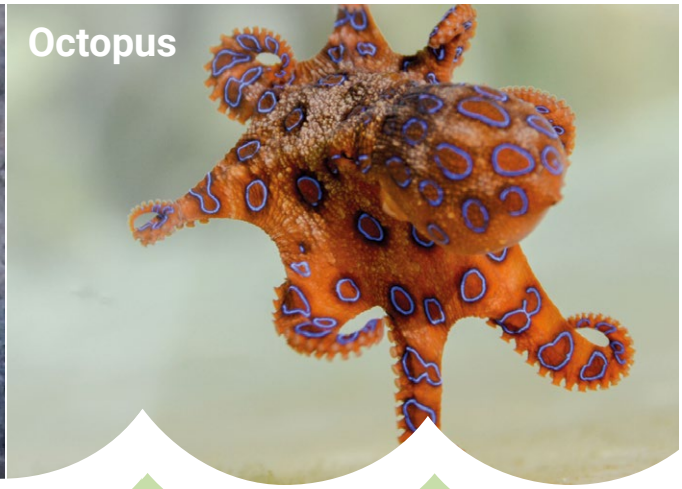
Predators are a danger to many animals, so they have developed ways to keep themselves safe.

The Hawaiian bobtail squid hunt for food at night to hide from predators. They turn on a light that is within their bodies to attract prey and to prevent shadows appearing underneath them. The light is provided by type of bacterium called *Vibrio* that lives happily inside their body!

The blue-ringed octopus lives deep in the sea. They can protect themselves from the prey by first poisoning and then eating it. But they cannot make the toxic substance on their own… they need bacteria to make the toxin. The bacteria lives in their saliva!

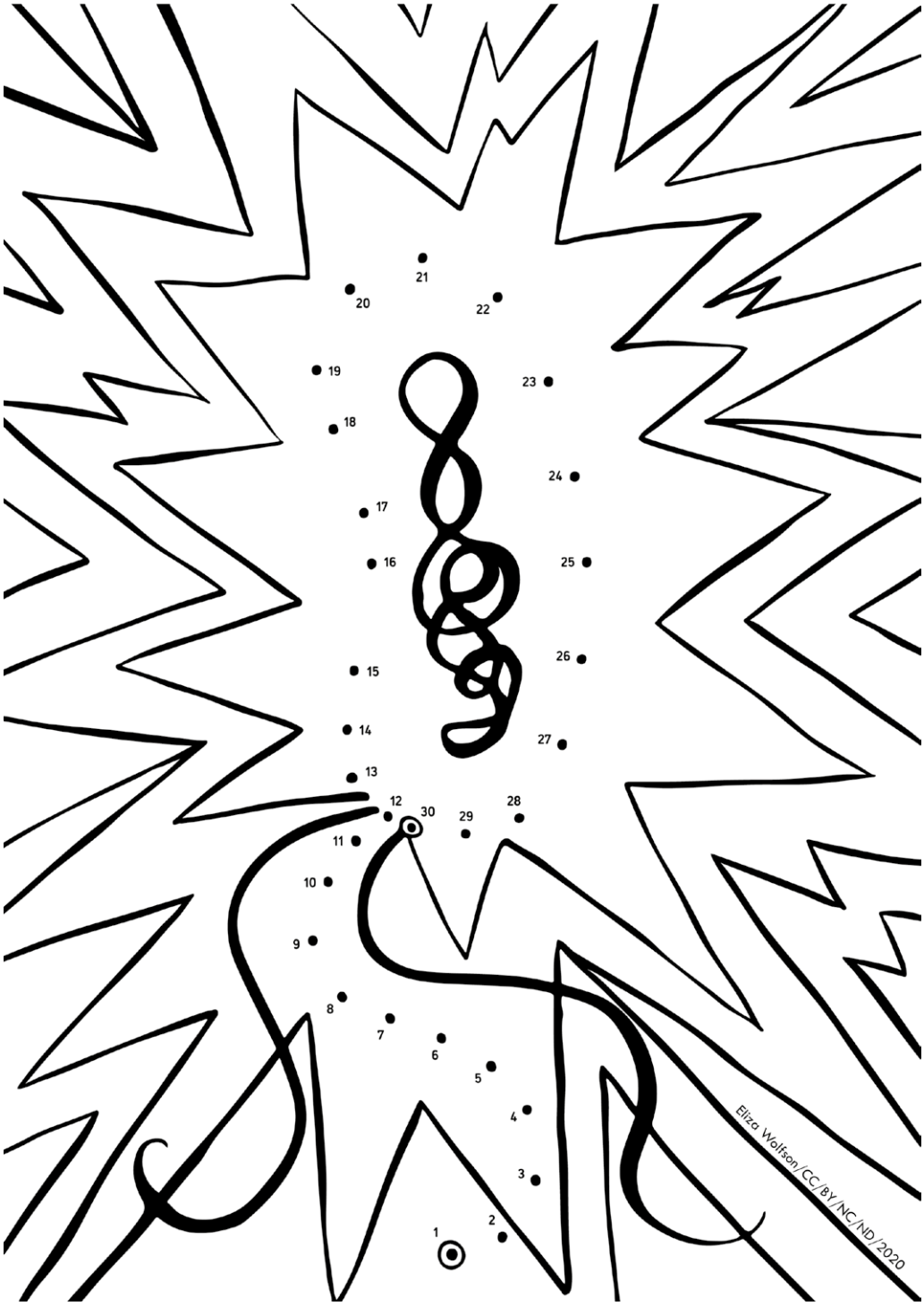
Image Credit: Narrissa Spies / CC BY-SA

Image Credit: Pen Ash from Pixabay



Activity 8:
Dot-to-Dot

Connect the dots in number order and colour in the picture to reveal the bacterium that can generate light.



Treating infections with antimicrobials

Some microbes can cause human or animal infections. Just now, many scientists are working very hard to find new ways to treat the virus called SARS-CoV-2, a coronavirus that causes COVID-19.

“Antimicrobials” are substances that kill a microbe or stop it from replicating (making more copies of itself). Antimicrobials are split into different groups depending on which microbe they target.

- Antivirals target viruses
- Antibiotics target bacteria
- Antifungals target fungi
- Antiparasitics target parasites

Antimicrobials are an important part of modern medicine. Without effective antibiotics many common surgeries and accidents could become life threatening.

Image credit: Nicola Stanley-Wall, Bell Baxter High School and Lewis J Houghton

Did you know that Scottish biologist and doctor Sir Alexander Fleming was involved in the development of penicillin, an antibiotic that we still use today?

Antimicrobial Resistance

Antimicrobials are amazing tools for treating many different infections. However, over time microbes can develop ways to resist the medicines, which means the antimicrobial will no longer work – this is called resistance. The resistance can happen naturally as microbes reproduce very quickly and change to allow them to grow in the presence of the medicine. Because antimicrobials are used a lot in medicine and agriculture this has made them change more quickly. Therefore, it is very important only to take antibiotics (and other medicines) when you are told to by a doctor and to follow the prescription guidance.

Activity 9:

Antimicrobial Word Search

Can you find all the words in this word search? Look closely.

B	A	C	T	E	R	I	A	L	I	T	A	I	I
H	R	E	S	I	S	T	A	N	C	E	I	P	I
I	A	N	C	E	E	I	A	L	N	A	E	S	N
G	I	L	U	M	S	A	N	F	N	N	U	I	F
N	S	I	O	C	L	I	G	T	I	I	E	R	E
I	U	L	N	I	N	I	I	C	A	L	F	T	C
M	R	N	G	T	E	B	I	S	U	P	U	P	T
E	I	C	P	A	I	L	N	A	S	S	N	O	I
L	V	A	I	O	L	L	I	I	B	F	G	I	O
F	G	M	T	I	L	T	M	N	C	A	I	I	N
I	A	I	N	N	B	I	M	G	I	S	O	I	L
I	C	A	M	L	A	R	I	V	I	T	N	A	F
T	I	E	L	F	L	A	L	E	I	I	F	T	L
N	I	I	V	N	E	E	T	I	S	A	R	A	P

Antiviral

Bacteria

Fleming

Antibiotic

Resistance

Penicillin

Virus

Soil

Infection

Halo

Answers are on page 16

Answers to Activities:

Activity 2: Word Finder
2-letter words: so, in, on, no, as, an, am, go
3-letter words: car, arm, aim, arc, can, man, cog
4-letter words: scam, cram, coma
5-letter words: comma, mimic, magic, manic, among, congo
6-letter words: magics, mimics, common, coming, gammon, miming
7-letter words: commons, maiming, ramming, anosmic, crimson, organic
8-letter words: organics, organism, scarring, monogram, cramming, scamming
9-letter words: scramming, microgram, groomsman

Activity 6: Health and Safety
Lesley-Anne has hair tied back, lab coat and long trousers.
Irene is wearing safety goggles, gloves and closed shoes.

Activity 9: Antimicrobial Word Search

B	**A**	**C**	**T**	**E**	**R**	**I**	**A**	L	I	T	A	I	I
H	**R**	**E**	**S**	**I**	**S**	**T**	**A**	**N**	**C**	**E**	I	**P**	**I**
I	**A**	N	C	E	E	I	A	L	N	**A**	**E**	S	**N**
G	I	**L**	U	M	S	A	N	F	**N**	**N**	U	I	**F**
N	S	I	**O**	C	L	I	G	**T**	**I**	I	E	R	**E**
I	U	L	N	I	N	I	**I**	**C**	A	L	F	T	**C**
M	R	N	G	T	E	**B**	**I**	S	U	P	U	P	**T**
E	I	C	P	A	**I**	**L**	N	A	S	S	N	O	**I**
L	V	A	I	**O**	**L**	L	I	I	B	F	G	I	**O**
F	G	M	**T**	**I**	L	T	M	N	C	A	I	I	**N**
I	A	**I**	**N**	N	B	I	M	G	I	**S**	**O**	**I**	**L**
I	**C**	A	M	**L**	**A**	**R**	**I**	**V**	**I**	**T**	**N**	**A**	F
T	I	E	L	F	L	A	L	E	I	I	F	T	L
N	I	I	V	N	E	E	T	I	S	A	R	A	P

Microbes in nature: Believe it or not

Bacteria live together

In nature, bacteria live in groups called “biofilms”. In a biofilm, bacteria stick to surfaces or each other. The dental plaque on your teeth is an example of a biofilm. To build the biofilm, bacteria need to make materials to coat both them and their neighbours. Some bacteria make a coat that is waterproof.

Look at the biofilm below. The coloured water drops just sit on top. The biofilm is more “hydrophobic” (water repelling) than the Teflon™ coating in frying pans. Now that is amazing!

Biofilm

Image credit: Prof. Nicola Stanley-Wall’s laboratory, University of Dundee

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